

Abstract Title: Overview of Results from the SIR-C/X-SAR Mission

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## Overview of Results from the SIR-C/X-SAR Mission

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### ABSTRACT

The US Space Transportation System, or Shuttle, has shown itself to be a useful platform from which to evaluate remote sensing instrumentation for later use in a free-flying satellite. Such flights have also produced significant science on their own. The Spaceborne Imaging Radar (SIR) program, consisting of Shuttle flights in 1981, 1984 and 1994, has both matured the state of the art of synthetic aperture radar (SAR) imaging and proven the capability of such systems to extend our knowledge of Earth. The latest of the SIR series, SIR-C, consists of both L- and C- band polarimetric SARs. SIR-C has been combined with X-SAR, an X-band W-polarized SAR, and MAPS, an air pollution measuring device, to form the Spaceborne Radar Lab (SRL), which at this writing is to fly aboard Shuttle in April and again in August 1994. Thus, with multiple passes over each site, SRL should produce multi-temporal data from its targets at multiple look angles, multiple wavelengths, and (at two wavelengths) across the full spectrum of polarizations. With such a deep data set, more extensive and longer lived missions can limit their efforts to the diversity required to address specific issues.

As an advance in remote sensing research, SRL seeks to provide information about land and ocean surfaces and vegetation cover that is unique or complementary to measurements made by sensors operating in other portions of the spectrum. SAR has the obvious advantage of providing its own illumination and of penetrating through

clouds, making it possible to explore regions that are not accessible either directly or using other instrumentation. SAR also can enhance topographic features due to the side-looking geometry. The exciting prospect of interferometry will also be investigated in the second SRI flight. In targets such as vegetation, ice, and dry alluvial or aeolian soils, SAR can provide additional information about subsurface or deep-target geometry as well.

Scientifically, SRI responds to S-1 investigators with over 400 sites. Central themes of their investigations are the global carbon cycle, the hydrologic cycle, paleoclimate and geologic processes, ocean circulation and air-sea interactions, and advanced technology. In each case, the goal is to feed the development of invertible models which produce maps of bio- or geophysical parameters such as soil moisture, biomass surface roughness, etc.

Anticipated science outcomes of the SIR-C/X-SAR experiments include:

- establishment of a methodology to estimate soil moisture and evaporation rates

- determination of past slip rates on active faults from knowledge of the ages of offset surfaces; derivation of significant new data on joint systems and fold structures, Pleistocene paleodrainage systems and archaeological geology

- improved understanding of radar backscatter and penetration in hyperarid to semiarid terrains

- validation of theoretical scattering models for forested sites

- insight into the feasibility of crop type classification with multi-frequency, polarimetric data

- more complete regional view of the eruptive history for classical shield volcanoes

- new models describing the mechanisms involved in SAR imaging of ocean features

- mapping of seepage zones in areas of internal drainage and salt-lake formation by using variations in dielectric constant to determine moisture contents and conducting salt layers

- improvement in the monitoring of wetland hydrologic regimes

- improvement in the understanding of the capabilities of spaceborne SAR for detection of physical properties of the seasonal snow cover and glaciers

- measurement of the effect of precipitation on SIR-C surface measurements; obtaining of the first precipitation polarization measurements from space; quantitative evaluation of the rainfall rate and velocity, and height of rain clouds

In this paper we will report the sensor and mission performance during the SRI flights and describe early results of the scientific investigations.